AUTOMATED DETECTION SITE MORPHOLOGY CLASSIFICATION SYSTEM

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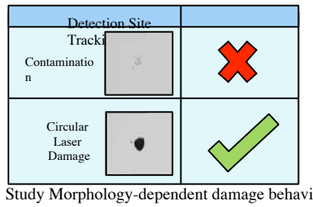
Abstract

We propose to use the Image Analysis Classification (ICA) algorithm to automatically classify the detection sites found on NIF Optics. We have developed a comprehensive classification system and identified training images for evaluation. We have run preliminary evaluations of ICA's accuracy and the results indicate that the accuracy of the algorithm is dependent upon the number of training images and the morphology type.

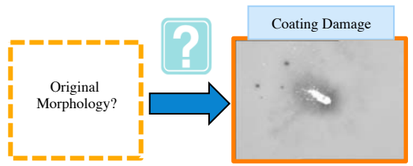
Introduction

We have collected images of various detection sites, taken by a microscope, on the NIF Final Optics. We would like to automate the process of classifying these sites. This project offers two potential benefits:

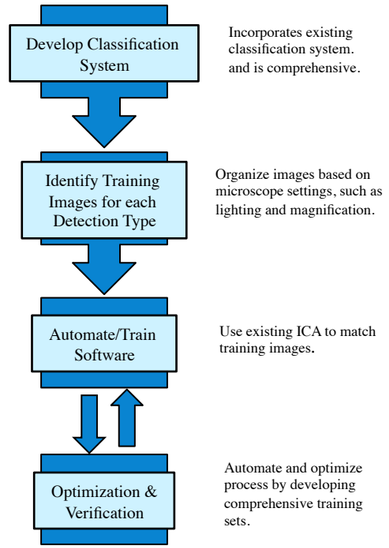
•**Operations**: Strategic Tracking of sites



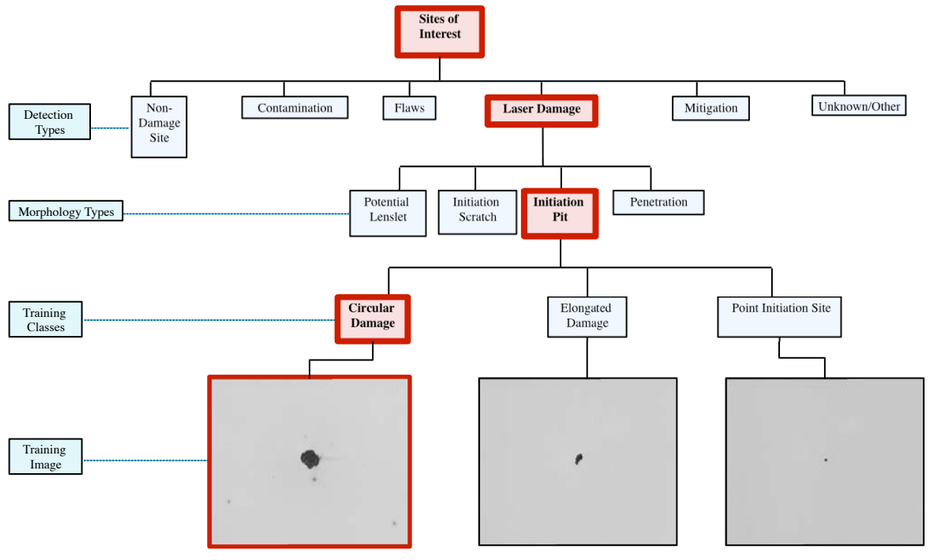
•**Research**: Study Morphology-dependent damage behavior



Method



Classification



Machine Training

- IAC sorts images using wavelet transformations.
- User determines the cut-off point.
- Each morphology type has a different cut-off value.
- User can manually select any combination of number of images to train ICA algorithm.

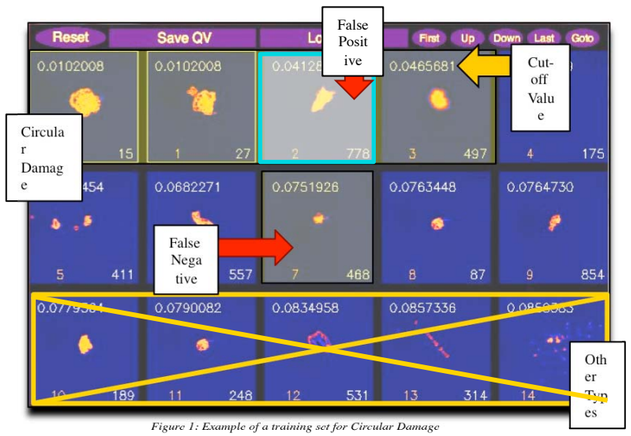


Figure 1: Example of a training set for Circular Damage

Results and Conclusion

- 361 randomly chosen images are fed into IAC to evaluate the accuracy of the algorithm's classification.
- A set of 2, 3, 5, and 8 training images is used to test IAC for a dependency on the number of training images used.
- In addition to evaluating the accuracy of the algorithm, we also focus on minimizing the false negatives in order to prevent a damage site from being classified as a benign site.

Morphology Truth*	Number of
Circular Damage	39 images
Point Initiation Site	25 images
Elongated Damage	24 images

*manually determined

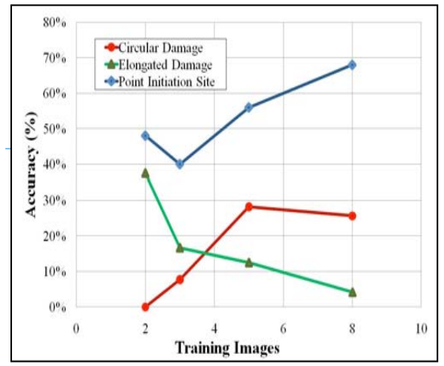


Figure 2: Plot of the number of training images used vs. the accuracy of the ICA algorithm

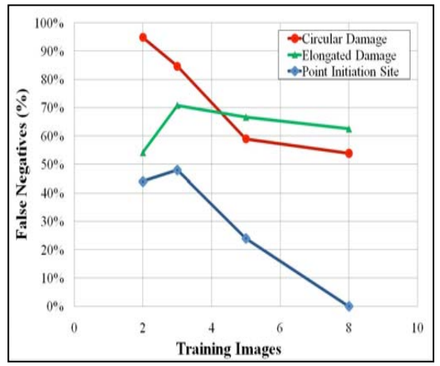


Figure 3: Plot of the number of training images used vs. the % yield of false negatives

- For symmetric morphologies (Circular Damage and Point Initiation Sites) increasing the number of training images, in general, increases the accuracy and reduces the number of false negatives.
- For asymmetric morphologies (Elongated Damage) an inverse dependency on the number of training images is observed. This result suggests that different techniques are required to optimize the accuracy of IAC for these types of morphologies.

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